

## Appendix 2 Supplemental Methods [posted as supplied by author]

### Prediction of blood pressure at different gestational ages from normograms

To prevent women who had many measurements of blood pressure during pregnancy from having too high an influence on the models, we randomly selected one blood pressure measurement per woman for any 2-week period where the woman had more than one measurement for inclusion in the models. This led to a median and interquartile range of 10 (9 to 11) blood pressure measurements per woman included in the models.

We included pre-pregnancy BMI in the multilevel models in four categories: underweight ( $<18.5 \text{ kg/m}^2$ ), normal weight ( $18.5\text{-}24.9 \text{ kg/m}^2$ ), overweight ( $25\text{-}29.9 \text{ kg/m}^2$ ) and obese ( $\geq 30 \text{ kg/m}^2$ ) as a covariate and also included an interaction between BMI category and each of the splines to allow the shape of the BP trajectory to differ by BMI category. Smoking (any smoking or never smoked) was also included as a categorical covariate and as an interaction with each of the splines. We fitted separate models for nulliparous and multiparous women.

The equation of the multilevel model for blood pressure change across pregnancy was:

$$\begin{aligned}
 y_{ij} = & \beta_0 + u_{0j} + (\beta_1 + u_{1j})\text{spline1}_{ij} + (\beta_2 + u_{2j})\text{spline2}_{ij} + (\beta_3 + u_{3j})\text{spline3}_{ij} + (\beta_4 + u_{4j})\text{spline4}_{ij} + \\
 & \beta_5 \text{underweight}_j + \beta_6 \text{overweight}_j + \beta_7 \text{obese}_j + \\
 & \beta_8 \text{underweight}_j \times \text{spline1}_{ij} + \beta_9 \text{overweight}_j \times \text{spline1}_{ij} + \beta_{10} \text{obese}_j \times \text{spline1}_{ij} + \\
 & \beta_{11} \text{underweight}_j \times \text{spline2}_{ij} + \beta_{12} \text{overweight}_j \times \text{spline2}_{ij} + \beta_{13} \text{obese}_j \times \text{spline2}_{ij} + \\
 & \beta_{14} \text{underweight}_j \times \text{spline3}_{ij} + \beta_{15} \text{overweight}_j \times \text{spline3}_{ij} + \beta_{16} \text{obese}_j \times \text{spline3}_{ij} + \\
 & \beta_{17} \text{underweight}_j \times \text{spline4}_{ij} + \beta_{18} \text{overweight}_j \times \text{spline4}_{ij} + \beta_{19} \text{obese}_j \times \text{spline4}_{ij} + \\
 & \beta_{20} \text{smoking}_j + \beta_{21} \text{smoking}_j \times \text{spline1}_{ij} + \beta_{22} \text{smoking}_j \times \text{spline2}_{ij} + \beta_{23} \text{smoking}_j \times \text{spline3}_{ij} + \\
 & \beta_{24} \text{smoking}_j \times \text{spline4}_{ij} + \\
 & e_{0ij} + e_{1ij}(GA_{ij} - 12)
 \end{aligned}$$

$$\begin{bmatrix} u_{0j} \\ u_{1j} \\ u_{2j} \\ u_{3j} \\ u_{4j} \end{bmatrix} \sim N(\mathbf{0}, \Omega_u), \begin{bmatrix} e_{0ij} \\ e_{1ij} \end{bmatrix} \sim N(\mathbf{0}, \Omega_e)$$

where,  $y_{ij}$  is the value of the  $i^{th}$  MAP measurement on the  $j^{th}$  individual,  $\beta_0-\beta_{24}$  describe the average trajectory of change,  $u_{0j}-u_{4j}$  describe how the  $j^{th}$  individual's trajectory of MAP deviates from the average and  $GA_{ij}$  is the gestational age in weeks of the  $i^{th}$  measurement on the  $j^{th}$  individual. It is centred at 12 weeks in order to set the intercept,  $\beta_0$ , to represent blood pressure at 12 weeks. The  $e_{0ij}$  and  $e_{1ij}$  terms describe the deviation of the  $i^{th}$  measurement of MAP on the  $j^{th}$  individual from the individual's trajectory. These are residual error terms.

The model was fitted separately for nulliparous and multiparous women rather than including parity as additional covariate, to allow for greater flexibility in the shape and variability of the trajectories for nulliparous and multiparous women.

The splines are defined as: (1)

$$spline 1_{ij} = GA_{ij} - 12$$

$$spline 2_{ij} = \frac{(GA_{ij} - 11)_+ - (40 - 36)^{-1} \{(GA_{ij} - 36)_+^3 (40 - 11) - (GA_{ij} - 40)_+^3 (36 - 11)\}}{(40 - 11)^2}$$

$$spline 3_{ij} = \frac{(GA_{ij} - 18)_+ - (40 - 36)^{-1} \{(GA_{ij} - 36)_+^3 (40 - 18) - (GA_{ij} - 40)_+^3 (36 - 18)\}}{(40 - 11)^2}$$

$$spline 4_{ij} = \frac{(GA_{ij} - 30)_+ - (40 - 36)^{-1} \{(GA_{ij} - 36)_+^3 (40 - 30) - (GA_{ij} - 40)_+^3 (36 - 30)\}}{(40 - 11)^2}$$

$$\text{where } (x)_+ = \begin{cases} 0 & \text{if } x \leq 0 \\ x & \text{if } x > 0 \end{cases}$$

To calculate predictions conditional on the initial blood pressure measurement we used the multilevel models as above, and applied the method described by Tilling et al(2) and Pan and Goldstein.(3)

The between-individual variance for individual  $j$  at the initial visit is:

$$V_{blj} = \begin{bmatrix} 1 \\ spline1_{1j} \\ spline2_{1j} \\ spline3_{1j} \\ spline4_{1j} \end{bmatrix}^T \Omega_u \begin{bmatrix} 1 \\ spline1_{1j} \\ spline2_{1j} \\ spline3_{1j} \\ spline4_{1j} \end{bmatrix}$$

The within-individual variance for individual  $j$  at the initial visit is:

$$V_{wl} = \begin{bmatrix} 1 \\ GA_{1j} - 12 \end{bmatrix}^T \Omega_e \begin{bmatrix} 1 \\ GA_{1j} - 12 \end{bmatrix}.$$

The covariance between the deviations from the predicted curve at the initial visit (indexed

1) and  $g$  weeks for the  $j$ th individual is:  $V_{bl,gj} = \begin{bmatrix} 1 \\ spline1_{1j} \\ spline2_{1j} \\ spline3_{1j} \\ spline4_{1j} \end{bmatrix}^T \Omega_u \begin{bmatrix} 1 \\ spline1_{gj} \\ spline2_{gj} \\ spline3_{gj} \\ spline4_{gj} \end{bmatrix}$

From these, the predicted blood pressure at gestational age  $g$  for individual  $j$ , conditional on the blood pressure value at the initial visit can be calculated as:

$$\begin{aligned}
y_{gj} = & \frac{\hat{V}_{b1,gj}}{\hat{V}_{b1j} + \hat{V}_{w1j}} (y_{1j} - \hat{\beta}_0 + \hat{\beta}_1 \text{spline1}_1 + \hat{\beta}_2 \text{spline2}_1 + \hat{\beta}_3 \text{spline3}_1 + \hat{\beta}_4 \text{spline4}_1 + \\
& \hat{\beta}_5 \text{underweight}_j + \hat{\beta}_6 \text{overweight}_j + \hat{\beta}_7 \text{obese}_j + \\
& \hat{\beta}_8 \text{underweight}_j \times \text{spline1}_{1j} + \hat{\beta}_9 \text{overweight}_j \times \text{spline1}_{1j} + \hat{\beta}_{10} \text{obese}_j \times \text{spline1}_{1j} + \\
& \hat{\beta}_{11} \text{underweight}_j \times \text{spline2}_{1j} + \hat{\beta}_{12} \text{overweight}_j \times \text{spline2}_{1j} + \hat{\beta}_{13} \text{obese}_j \times \text{spline2}_{1j} + \\
& \hat{\beta}_{14} \text{underweight}_j \times \text{spline3}_{1j} + \hat{\beta}_{15} \text{overweight}_j \times \text{spline3}_{1j} + \hat{\beta}_{16} \text{obese}_j \times \text{spline3}_{1j} + \\
& \hat{\beta}_{17} \text{underweight}_j \times \text{spline4}_{1j} + \hat{\beta}_{18} \text{overweight}_j \times \text{spline4}_{1j} + \hat{\beta}_{19} \text{obese}_j \times \text{spline4}_{1j} + \\
& \hat{\beta}_{20} \text{smoking}_j + \hat{\beta}_{21} \text{smoking}_j \times \text{spline1}_{1j} + \hat{\beta}_{22} \text{smoking}_j \times \text{spline2}_{1j} + \hat{\beta}_{23} \text{smoking}_j \times \text{spline3}_{1j} + \\
& \hat{\beta}_{24} \text{smoking}_j \times \text{spline4}_{1j}) + \\
& \hat{\beta}_0 + \hat{\beta}_1 \text{spline1}_{gj} + \hat{\beta}_2 \text{spline2}_{gj} + \hat{\beta}_3 \text{spline3}_{gj} + \hat{\beta}_4 \text{spline4}_{gj} + \\
& \hat{\beta}_5 \text{underweight}_j + \hat{\beta}_6 \text{overweight}_j + \hat{\beta}_7 \text{obese}_j + \\
& \hat{\beta}_8 \text{underweight}_j \times \text{spline1}_{gj} + \hat{\beta}_9 \text{overweight}_j \times \text{spline1}_{gj} + \hat{\beta}_{10} \text{obese}_j \times \text{spline1}_{gj} + \\
& \hat{\beta}_{11} \text{underweight}_j \times \text{spline2}_{gj} + \hat{\beta}_{12} \text{overweight}_j \times \text{spline2}_{gj} + \hat{\beta}_{13} \text{obese}_j \times \text{spline2}_{gj} + \\
& \hat{\beta}_{14} \text{underweight}_j \times \text{spline3}_{gj} + \hat{\beta}_{15} \text{overweight}_j \times \text{spline3}_{gj} + \hat{\beta}_{16} \text{obese}_j \times \text{spline3}_{gj} + \\
& \hat{\beta}_{17} \text{underweight}_j \times \text{spline4}_{gj} + \hat{\beta}_{18} \text{overweight}_j \times \text{spline4}_{gj} + \hat{\beta}_{19} \text{obese}_j \times \text{spline4}_{gj} + \\
& \hat{\beta}_{20} \text{smoking}_j + \hat{\beta}_{21} \text{smoking}_j \times \text{spline1}_{gj} + \hat{\beta}_{22} \text{smoking}_j \times \text{spline2}_{gj} + \hat{\beta}_{23} \text{smoking}_j \times \text{spline3}_{gj} + \\
& \hat{\beta}_{24} \text{smoking}_j \times \text{spline4}_{gj}
\end{aligned}$$

Where  $y_{1j}$  is the observed value of the outcome (MAP) at the initial visit. Thus, the deviation of the initial measurement from the average trajectory was combined with the multilevel model information to predict what trajectory would be seen for the rest of gestation.

## Multiple imputation of missing values in ALSPAC and the SWS

The same variables were included in multiple imputation models in both ALSPAC and SWS. A separate imputation was done for blood pressure at each gestational age: 20, 25, 28, 31, 34 and 36 weeks, imputing only to the number of women who still had not delivered at each gestation. The variables included were either exposures/covariates to include in prediction models, outcomes or predictors of missingness. The variables included and information about how they were included in multiple imputation models are shown in the table below:

<b>Variable</b>	<b>Type of variable</b>	<b>Model used to predict missing data in this variable</b>	<b>How variable was entered in models to predict missing data in other variables</b>
MAP at initial visit	Continuous	Linear regression	Continuous
MAP at X weeks	Continuous	Linear regression	Continuous
Preeclampsia	Binary	Logistic regression	Binary
Offspring small for gestational age	Binary	Logistic regression	Binary
Customised small for gestational age	Binary	Logistic regression	Binary
Gestational age at delivery	Continuous	No missing data	Continuous
Pre-existing maternal hypertension	Binary	Logistic regression	Binary
Previous gestational hypertension	Binary	Logistic regression	Binary

Previous gestational diabetes	Binary	Logistic regression	Binary
Pre-existing diabetes	Binary	Logistic regression	Binary
Maternal age	Continuous	Linear regression	Continuous
Parity	Ordered categorical (3 categories)	Ordinal logistic regression	2 indicator variables
Maternal weight	Skewed continuous	Log-linear regression	Continuous
Maternal height	Continuous	Linear regression	Continuous
Maternal smoking	Binary	Logistic regression	Binary
Maternal education	Ordered categorical (4 categories)	Ordinal logistic regression	3 indicator variables
Household social class	Ordered categorical (5 categories)	Ordinal logistic regression	4 indicator variables
Maternal non-white ethnicity	Binary	Logistic regression	Binary
Offspring sex	Binary	Logistic regression	Binary

### Prediction Models for Preeclampsia:

The logistic regression models used to predict preeclampsia in ALSPAC are shown below. The risk of preeclampsia is calculated as

$$\frac{\exp(\beta X)}{1 + \exp(\beta X)}$$

where  $\beta X$  is as follows:

map\_1 = MAP at the initial visit

matsmok = Maternal smoking in the first trimester

matbmi = Maternal pre-pregnancy BMI

esshyp = Essential hypertension

matheight = Maternal height

prev\_gesthyp = Gestational hypertension in a previous pregnancy

mat\_over 35 = Maternal age over 35 years

prev\_diab = Existing diabetes

par2 = Parity of 1

prev\_gestdiab = Gestational diabetes in a previous pregnancy

par3 = Parity of 2 or more

mat\_nonwhite = Maternal non-white ethnicity

#### Model 1

$$\begin{aligned}
 & -3.46 + 0.046 * \text{map\_1} + 0.057 * \text{matbmi} - 0.024 * \text{matheight} + 0.384 * \text{mat\_over35} - 1.590 * \text{par2} - 1.546 * \text{par3} - 0.479 * \text{matsmok} + 0.793 * \text{esshyp} + \\
 & 1.346 * \text{prev\_gesthyp} + 2.301 * \text{prev\_diab} + 0.941 * \text{prev\_gestdiab} + 0.429 * \text{mat\_nonwhite}
 \end{aligned}$$

## Model 2

**20 weeks gestation:**  $-3.57 + 0.060*\text{map\_20wks} + 0.023*\text{map\_1} + 0.036*\text{matbmi} - 0.031*\text{matheight} + 0.319*\text{mat\_over35} - 1.535*\text{par2} - 1.499*\text{par3} - 0.446*\text{matsmok} + 0.545*\text{esshyp} + 1.162*\text{prev\_gesthyp} + 2.208*\text{prev\_diab} + 0.896*\text{prev\_gestdiab} + 0.520*\text{mat\_nonwhite}$

**25 weeks gestation:**  $-3.65 + 0.077*\text{map\_25wks} + 0.019*\text{map\_1} + 0.030*\text{matbmi} - 0.031*\text{matheight} + 0.308*\text{mat\_over35} - 1.447*\text{par2} - 1.389*\text{par3} - 0.411*\text{matsmok} + 0.484*\text{esshyp} + 1.130*\text{prev\_gesthyp} + 2.089*\text{prev\_diab} + 0.870*\text{prev\_gestdiab} + 0.555*\text{mat\_nonwhite}$

**28 weeks gestation:**  $-3.75 + 0.087*\text{map\_28wks} + 0.017*\text{map\_1} + 0.030*\text{matbmi} - 0.032*\text{matheight} + 0.383*\text{mat\_over35} - 1.448*\text{par2} - 1.414*\text{par3} - 0.398*\text{matsmok} + 0.356*\text{esshyp} + 0.977*\text{prev\_gesthyp} + 2.143*\text{prev\_diab} + 0.948*\text{prev\_gestdiab} + 0.559*\text{mat\_nonwhite}$

**31 weeks gestation:**  $-3.79 + 0.088*\text{map\_31wks} + 0.014*\text{map\_1} + 0.038*\text{matbmi} - 0.028*\text{matheight} + 0.385*\text{mat\_over35} - 1.420*\text{par2} - 1.265*\text{par3} - 0.523*\text{matsmok} + 0.339*\text{esshyp} + 0.855*\text{prev\_gesthyp} + 1.857*\text{prev\_diab} + 0.773*\text{prev\_gestdiab} + 0.538*\text{mat\_nonwhite}$

**34 weeks gestation:**  $-3.93 + 0.092*\text{map\_34wks} + 0.019*\text{map\_1} + 0.030*\text{matbmi} - 0.029*\text{matheight} + 0.330*\text{mat\_over35} - 1.306*\text{par2} - 1.196*\text{par3} - 0.590*\text{matsmok} + 0.222*\text{esshyp} + 0.746*\text{prev\_gesthyp} + 1.460*\text{prev\_diab} + 0.533*\text{prev\_gestdiab} + 0.560*\text{mat\_nonwhite}$

**36 weeks gestation:**  $-4.32 + 0.113*\text{map\_36wks} + 0.016*\text{map\_1} + 0.023*\text{matbmi} - 0.029*\text{matheight} + 0.136*\text{mat\_over35} - 1.166*\text{par2} - 1.075*\text{par3} - 0.411*\text{matsmok} - 0.134*\text{esshyp} + 0.550*\text{prev\_gesthyp} + 1.621*\text{prev\_diab} + 0.854*\text{prev\_gestdiab} + 0.684*\text{mat\_nonwhite}$

### Model 3

**20 weeks gestation:**  $-3.53 + 0.061*\text{map\_dev\_20} + 0.043*\text{map\_1} + 0.054*\text{matbmi} - 0.031*\text{matheight} + 0.321*\text{mat\_over35} - 1.589*\text{par2} - 1.553*\text{par3} - 0.491*\text{matsmok} + 0.541*\text{esshyp} + 1.164*\text{prev\_gesthyp} + 2.196*\text{prev\_diab} + 0.901*\text{prev\_gestdiab} + 0.531*\text{mat\_nonwhite}$

**25 weeks gestation:**  $-3.64 + 0.077*\text{map\_dev\_25} + 0.043*\text{map\_1} + 0.049*\text{matbmi} - 0.031*\text{matheight} + 0.309*\text{mat\_over35} - 1.515*\text{par2} - 1.456*\text{par3} - 0.452*\text{matsmok} + 0.479*\text{esshyp} + 1.136*\text{prev\_gesthyp} + 2.080*\text{prev\_diab} + 0.882*\text{prev\_gestdiab} + 0.566*\text{mat\_nonwhite}$

**28 weeks gestation:**  $-3.69 + 0.087*\text{map\_dev\_28} + 0.042*\text{map\_1} + 0.049*\text{matbmi} - 0.033*\text{matheight} + 0.384*\text{mat\_over35} - 1.532*\text{par2} - 1.496*\text{par3} - 0.441*\text{matsmok} + 0.351*\text{esshyp} + 0.981*\text{prev\_gesthyp} + 2.139*\text{prev\_diab} + 0.964*\text{prev\_gestdiab} + 0.568*\text{mat\_nonwhite}$

**31 weeks gestation:**  $-3.76 + 0.088*\text{map\_dev\_31} + 0.039*\text{map\_1} + 0.059*\text{matbmi} - 0.028*\text{matheight} + 0.385*\text{mat\_over35} - 1.517*\text{par2} - 1.361*\text{par3} - 0.570*\text{matsmok} + 0.338*\text{esshyp} + 0.861*\text{prev\_gesthyp} + 1.852*\text{prev\_diab} + 0.790*\text{prev\_gestdiab} + 0.545*\text{mat\_nonwhite}$

**34 weeks gestation:**  $-3.90 + 0.093*\text{map\_dev\_34} + 0.046*\text{map\_1} + 0.060*\text{matbmi} - 0.029*\text{matheight} + 0.333*\text{mat\_over35} - 1.437*\text{par2} - 1.330*\text{par3} - 0.649*\text{matsmok} + 0.214*\text{esshyp} + 0.744*\text{prev\_gesthyp} + 1.441*\text{prev\_diab} + 0.544*\text{prev\_gestdiab} + 0.575*\text{mat\_nonwhite}$

**36 weeks gestation:**  $-4.22 + 0.113*\text{map\_dev\_36} + 0.050*\text{map\_1} + 0.073*\text{matbmi} - 0.029*\text{matheight} + 0.133*\text{mat\_over35} - 1.370*\text{par2} - 1.294*\text{par3} - 0.502*\text{matsmok} - 0.127*\text{esshyp} + 0.546*\text{prev\_gesthyp} + 1.609*\text{prev\_diab} + 0.831*\text{prev\_gestdiab} + 0.702*\text{mat\_nonwhite}$

### Prediction Models for Preterm Birth:

The logistic regression models used to predict preterm birth in ALSPAC are shown below. The risk of preterm birth is calculated as

$$\frac{\exp(\beta X)}{1 + \exp(\beta X)}$$

where  $\beta X$  is as follows:

map\_1 = MAP at the initial visit

esshyp = Essential hypertension

norm\_wt = normal weight

matheight = Maternal height

over\_wt = overweight

prev\_gesthyp = Gestational hypertension in a previous pregnancy

obese = obese

prev\_diab = Existing diabetes

par2 = Parity of 1

prev\_gestdiab = Gestational diabetes in a previous pregnancy

par3 = Parity of 2 or more

mat\_nonwhite = Maternal non-white ethnicity

#### Model 1

$$\begin{aligned}
 & -2.39 - 0.003 * \text{map\_1} - 0.439 * \text{norm\_wt} - 0.468 * \text{over\_wt} - 0.562 * \text{obese} - 0.027 * \text{matheight} \\
 & - 0.501 * \text{par2} - 0.229 * \text{par3} + 0.497 * \text{esshyp} + \\
 & 0.403 * \text{prev\_gesthyp} + 2.026 * \text{prev\_diab} + 1.167 * \text{prev\_gestdiab} + 0.746 * \text{mat\_nonwhite}
 \end{aligned}$$

## Model 2

**20 weeks gestation:**  $-2.38 + 0.005*\text{map\_20wks} - 0.005*\text{map\_1} - 0.447*\text{norm\_wt} - 0.487*\text{over\_wt} - 0.592*\text{obese} - 0.028*\text{matheight} - 0.496*\text{par2} - 0.223*\text{par3} + 0.474*\text{esshyp} + 0.387*\text{prev\_gesthyp} + 2.016*\text{prev\_diab} + 1.164*\text{prev\_gestdiab} + 0.753*\text{mat\_nonwhite}$

**25 weeks gestation:**  $-2.37 + 0.023*\text{map\_25wks} - 0.011*\text{map\_1} - 0.477*\text{norm\_wt} - 0.549*\text{over\_wt} - 0.679*\text{obese} - 0.029*\text{matheight} - 0.465*\text{par2} - 0.191*\text{par3} + 0.406*\text{esshyp} + 0.343*\text{prev\_gesthyp} + 1.889*\text{prev\_diab} + 1.148*\text{prev\_gestdiab} + 0.776*\text{mat\_nonwhite}$

**28 weeks gestation:**  $-2.46 + 0.030*\text{map\_28wks} - 0.014*\text{map\_1} - 0.451*\text{norm\_wt} - 0.548*\text{over\_wt} - 0.709*\text{obese} - 0.030*\text{matheight} - 0.447*\text{par2} - 0.150*\text{par3} + 0.363*\text{esshyp} + 0.311*\text{prev\_gesthyp} + 1.908*\text{prev\_diab} + 1.045*\text{prev\_gestdiab} + 0.735*\text{mat\_nonwhite}$

**31 weeks gestation:**  $-2.59 + 0.049*\text{map\_31wks} - 0.023*\text{map\_1} - 0.450*\text{norm\_wt} - 0.542*\text{over\_wt} - 0.748*\text{obese} - 0.031*\text{matheight} - 0.379*\text{par2} - 0.082*\text{par3} + 0.247*\text{esshyp} + 0.145*\text{prev\_gesthyp} + 1.702*\text{prev\_diab} + 1.057*\text{prev\_gestdiab} + 0.711*\text{mat\_nonwhite}$

**34 weeks gestation:**  $-2.95 + 0.068*\text{map\_34wks} - 0.024*\text{map\_1} - 0.422*\text{norm\_wt} - 0.619*\text{over\_wt} - 0.824*\text{obese} - 0.037*\text{matheight} - 0.222*\text{par2} + 0.029*\text{par3} + 0.014*\text{esshyp} + 0.038*\text{prev\_gesthyp} + 1.195*\text{prev\_diab} + 1.035*\text{prev\_gestdiab} + 0.743*\text{mat\_nonwhite}$

**36 weeks gestation:**  $-3.86 + 0.076*\text{map\_36wks} - 0.025*\text{map\_1} - 0.385*\text{norm\_wt} - 0.567*\text{over\_wt} - 0.748*\text{obese} - 0.046*\text{matheight} + 0.146*\text{par2} + 0.230*\text{par3} - 0.088*\text{esshyp} - 0.023*\text{prev\_gesthyp} + 1.173*\text{prev\_diab} + 0.723*\text{prev\_gestdiab} + 0.873*\text{mat\_nonwhite}$

## Model 3

**20 weeks gestation:**  $-2.39 + 0.006*\text{map\_dev\_20} - 0.003*\text{map\_1} - 0.441*\text{norm\_wt} - 0.468*\text{over\_wt} - 0.563*\text{obese} - 0.028*\text{matheight} - 0.501*\text{par2} - 0.228*\text{par3} + 0.471*\text{esshyp} + 0.385*\text{prev\_gesthyp} + 2.013*\text{prev\_diab} + 1.164*\text{prev\_gestdiab} + 0.754*\text{mat\_nonwhite}$

**25 weeks gestation:**  $-2.42 + 0.024*\text{map\_dev\_25} - 0.004*\text{map\_1} - 0.439*\text{norm\_wt} - 0.465*\text{over\_wt} - 0.559*\text{obese} - 0.029*\text{matheight} - 0.488*\text{par2} - 0.214*\text{par3} + 0.402*\text{esshyp} + 0.341*\text{prev\_gesthyp} + 1.882*\text{prev\_diab} + 1.148*\text{prev\_gestdiab} + 0.779*\text{mat\_nonwhite}$

**28 weeks gestation:**  $-2.50 + 0.031*\text{map\_dev\_28} - 0.004*\text{map\_1} - 0.396*\text{norm\_wt} - 0.437*\text{over\_wt} - 0.552*\text{obese} - 0.030*\text{matheight} - 0.479*\text{par2} - 0.182*\text{par3} + 0.358*\text{esshyp} + 0.309*\text{prev\_gesthyp} + 1.901*\text{prev\_diab} + 1.046*\text{prev\_gestdiab} + 0.738*\text{mat\_nonwhite}$

**31 weeks gestation:**  $-2.68 + 0.049*\text{map\_dev\_31} - 0.008*\text{map\_1} - 0.369*\text{norm\_wt} - 0.374*\text{over\_wt} - 0.490*\text{obese} - 0.031*\text{matheight} - 0.437*\text{par2} - 0.141*\text{par3} + 0.244*\text{esshyp} + 0.144*\text{prev\_gesthyp} + 1.695*\text{prev\_diab} + 1.057*\text{prev\_gestdiab} + 0.714*\text{mat\_nonwhite}$

**34 weeks gestation:**  $-3.06 + 0.068*\text{map\_dev\_34} - 0.003*\text{map\_1} - 0.334*\text{norm\_wt} - 0.397*\text{over\_wt} - 0.395*\text{obese} - 0.037*\text{matheight} - 0.319*\text{par2} - 0.071*\text{par3} + 0.011*\text{esshyp} + 0.036*\text{prev\_gesthyp} + 1.185*\text{prev\_diab} + 1.031*\text{prev\_gestdiab} + 0.748*\text{mat\_nonwhite}$

**36 weeks gestation:**  $-3.95 + 0.075*\text{map\_dev\_36} - 0.003*\text{map\_1} - 0.292*\text{norm\_wt} - 0.322*\text{over\_wt} - 0.135*\text{obese} - 0.046*\text{matheight} + 0.014*\text{par2} + 0.093*\text{par3} - 0.089*\text{esshyp} - 0.023*\text{prev\_gesthyp} + 1.165*\text{prev\_diab} + 0.718*\text{prev\_gestdiab} + 0.873*\text{mat\_nonwhite}$

### Prediction Models for Small-For-Gestational Age:

The logistic regression models used to predict small-for-gestational age in ALSPAC are shown below. The risk of small-for-gestational age is

calculated as  $\frac{\exp(\beta X)}{1 + \exp(\beta X)}$  where  $\beta X$  is as follows:

map\_1 = MAP at the initial visit

matsmok = Maternal smoking in the first trimester

norm\_wt = normal weight

esshyp = Essential hypertension

over\_wt = overweight

matheight = Maternal height

obese = obese

prev\_gesthyp = Gestational hypertension in a previous pregnancy

mat\_over 35 = Maternal age over 35 years

prev\_gestdiab = Gestational diabetes in a previous pregnancy

par2 = Parity of 1

mat\_nonwhite = Maternal non-white ethnicity

par3 = Parity of 2 or more

#### **Model 1**

-1.64 + 0.003\*map\_1 - 0.625\*norm\_wt - 0.791\*over\_wt - 1.072\*obese - 0.058\*matheight + 0.182\*mat\_over35 - 0.756\*par2 - 0.824\*par3 + 0.850\*matsmok + 0.447\*esshyp + 0.209\*prev\_gesthyp - 1.445\*prev\_gestdiab + 0.856\*mat\_nonwhite

## Model 2

**20 weeks gestation:** -1.64 + 0.000\*map\_20wks + 0.003\*map\_1 - 0.626\*norm\_wt - 0.792\* over\_wt - 1.073\*obese - 0.058\*matheight + 0.182\*mat\_over35 - 0.756\*par2 - 0.824\*par3 + 0.851\*matsmok + 0.446\*esshyp + 0.208\*prev\_gesthyp - 1.445\*prev\_gestdiab + 0.857\*mat\_nonwhite

**25 weeks gestation:** -1.64 - 0.004\*map\_25wks + 0.005\*map\_1 - 0.620\*norm\_wt - 0.777\* over\_wt - 1.051\*obese - 0.058\*matheight + 0.186\*mat\_over35 - 0.762\*par2 - 0.831\*par3 + 0.847\*matsmok + 0.463\*esshyp + 0.219\*prev\_gesthyp - 1.438\*prev\_gestdiab + 0.852\*mat\_nonwhite

**28 weeks gestation:** -1.63 + 0.003\*map\_28wks + 0.002\*map\_1 - 0.635\*norm\_wt - 0.804\*over\_wt - 1.093\*obese - 0.058\*matheight + 0.183\*mat\_over35 - 0.752\*par2 - 0.821\*par3 + 0.851\*matsmok + 0.428\*esshyp + 0.195\*prev\_gesthyp - 1.411\*prev\_gestdiab + 0.877\*mat\_nonwhite

**31 weeks gestation:** -1.63 + 0.013\*map\_31wks - 0.001\*map\_1 - 0.646\*norm\_wt - 0.829\*over\_wt - 1.127\*obese - 0.059\*matheight + 0.182\*mat\_over35 - 0.732\*par2 - 0.783\*par3 + 0.848\*matsmok + 0.342\*esshyp + 0.122\*prev\_gesthyp - 1.432\*prev\_gestdiab + 0.886\*mat\_nonwhite

**34 weeks gestation:**  $-1.64 + 0.020*\text{map\_34wks} - 0.003*\text{map\_1} - 0.648*\text{norm\_wt} - 0.861*\text{over\_wt} - 1.203*\text{obese} - 0.060*\text{matheight} + 0.171*\text{mat\_over35} - 0.692*\text{par2} - 0.745*\text{par3} + 0.857*\text{matsmok} + 0.254*\text{esshyp} + 0.069*\text{prev\_gesthyp} - 1.399*\text{prev\_gestdiab} + 0.921*\text{mat\_nonwhite}$

**36 weeks gestation:**  $-1.67 + 0.011*\text{map\_36wks} - 0.001*\text{map\_1} - 0.624*\text{norm\_wt} - 0.819*\text{over\_wt} - 1.158*\text{obese} - 0.059*\text{matheight} + 0.170*\text{mat\_over35} - 0.700*\text{par2} - 0.754*\text{par3} + 0.850*\text{matsmok} + 0.256*\text{esshyp} + 0.083*\text{prev\_gesthyp} - 1.360*\text{prev\_gestdiab} + 0.892*\text{mat\_nonwhite}$

### Model 3

**20 weeks gestation:**  $-1.64 + 0.001*\text{map\_dev\_20} + 0.003*\text{map\_1} - 0.625*\text{norm\_wt} - 0.791*\text{over\_wt} - 1.072*\text{obese} - 0.058*\text{matheight} + 0.182*\text{mat\_over35} - 0.756*\text{par2} - 0.824*\text{par3} + 0.850*\text{matsmok} + 0.445*\text{esshyp} + 0.207*\text{prev\_gesthyp} - 1.445*\text{prev\_gestdiab} + 0.857*\text{mat\_nonwhite}$

**25 weeks gestation:**  $-1.64 - 0.004*\text{map\_dev\_25} + 0.004*\text{map\_1} - 0.626*\text{norm\_wt} - 0.791*\text{over\_wt} - 1.071*\text{obese} - 0.058*\text{matheight} + 0.186*\text{mat\_over35} - 0.758*\text{par2} - 0.826*\text{par3} + 0.849*\text{matsmok} + 0.462*\text{esshyp} + 0.218*\text{prev\_gesthyp} - 1.438*\text{prev\_gestdiab} + 0.853*\text{mat\_nonwhite}$

**28 weeks gestation:**  $-1.63 + 0.004*\text{map\_dev\_28} + 0.003*\text{map\_1} - 0.630*\text{norm\_wt} - 0.792*\text{over\_wt} - 1.076*\text{obese} - 0.058*\text{matheight} + 0.183*\text{mat\_over35} - 0.756*\text{par2} - 0.825*\text{par3} + 0.850*\text{matsmok} + 0.427*\text{esshyp} + 0.194*\text{prev\_gesthyp} - 1.411*\text{prev\_gestdiab} + 0.877*\text{mat\_nonwhite}$

**31 weeks gestation:**  $-1.65 + 0.013*\text{map\_dev\_31} + 0.003*\text{map\_1} - 0.626*\text{norm\_wt} - 0.785*\text{over\_wt} - 1.060*\text{obese} - 0.059*\text{matheight} + 0.182*\text{mat\_over35} - 0.747*\text{par2} - 0.799*\text{par3} + 0.841*\text{matsmok} + 0.341*\text{esshyp} + 0.122*\text{prev\_gesthyp} - 1.432*\text{prev\_gestdiab} + 0.887*\text{mat\_nonwhite}$

**34 weeks gestation:**  $-1.67 + 0.020*\text{map\_dev\_34} + 0.003*\text{map\_1} - 0.625*\text{norm\_wt} - 0.798*\text{over\_wt} - 1.081*\text{obese} - 0.060*\text{matheight} + 0.172*\text{mat\_over35} - 0.720*\text{par2} - 0.774*\text{par3} + 0.844*\text{matsmok} + 0.254*\text{esshyp} + 0.069*\text{prev\_gesthyp} - 1.400*\text{prev\_gestdiab} + 0.921*\text{mat\_nonwhite}$

**36 weeks gestation:**  $-1.68 + 0.011*\text{map\_dev\_36} + 0.002*\text{map\_1} - 0.613*\text{norm\_wt} - 0.786*\text{over\_wt} - 1.072*\text{obese} - 0.059*\text{matheight} + 0.171*\text{mat\_over35} - 0.719*\text{par2} - 0.772*\text{par3} + 0.842*\text{matsmok} + 0.256*\text{esshyp} + 0.082*\text{prev\_gesthyp} - 1.361*\text{prev\_gestdiab} + 0.892*\text{mat\_nonwhite}$

## Recalibration in SWS

Prediction models for preeclampsia at each gestational age were recalibrated for use in the SWS using the equation:

$$\text{Logit}(\text{probability of preeclampsia in SWS}) = \alpha_{\text{recal}} + \beta_{\text{recal}} (\beta X_{\text{ALSPAC}})$$

where  $\beta X_{\text{ALSPAC}}$  are the parameters from the logistic regression in the ALSPAC cohort as detailed above and  $\alpha_{\text{recal}}$  and  $\beta_{\text{recal}}$  represent the extent to which the intercept and the slope respectively of the regression model need to be altered for recalibration to the SWS cohort.

The values of  $\alpha_{\text{recal}}$  and  $\beta_{\text{recal}}$  for each of the models at each gestational age are given in the table below.

**Table: Recalibration parameters for each of the prediction models for preeclampsia**

Gestational age	Model	$\alpha_{\text{recal}}$	$\beta_{\text{recal}}$
<b>Initial model</b>	1	-1.55 (-2.29, -0.82)	0.73 (0.51, 0.95)
<b>20 weeks</b>	2	-1.38 (-2.08, -0.68)	0.75 (0.54, 0.95)
	3	-1.38 (-2.08, -0.68)	0.74 (0.54, 0.95)
<b>25 weeks</b>	2	-1.38 (-2.04, -0.72)	0.73 (0.54, 0.93)
	3	-1.39 (-2.05, -0.73)	0.73 (0.53, 0.92)
<b>28 weeks</b>	2	-1.03 (-1.78, -0.28)	0.87 (0.66, 1.09)
	3	-1.03 (-1.79, -0.27)	0.87 (0.65, 1.09)
<b>31 weeks</b>	2	-0.85 (-1.54, -0.16)	0.93 (0.72, 1.14)
	3	-0.85 (-1.54, -0.16)	0.93 (0.72, 1.14)
<b>34 weeks</b>	2	-0.61 (-1.20, -0.01)	1.00 (0.80, 1.19)
	3	-0.61 (-1.21, -0.01)	0.99 (0.79, 1.19)
<b>36 weeks</b>	2	-0.53 (-1.29, -0.23)	0.98 (0.77, 1.18)
	3	-0.54 (-1.28, 0.19)	0.97 (0.77, 1.17)

## References

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